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Assessment of genetic variability and character association in promising genotypes of Mungbean [*Vigna radiata* (L.) Wilczek]

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Abstract
Character association study on seed yield and its component characters was made on forty genotypes in order to access genetic parameters namely variability, heritability and genetic advance. Simultaneously studies on character association for seed yield per plant and its component characters. The maximum variability was observed for number of branches per plant followed by biological yield per plant, seed yield per plant, 100 gm seed weight and number of pods per plant. Heritability estimates were found higher for all the traits except harvest index and 100 seed weight. High estimate of heritability coupled with genetic advance were observed for biological yield per plant, plant height and number of pods per plant for seed yield per plant, pods per plant and plant height indicating that these characters are least influenced by environmental variation. Seed yield per plant had significant and positive association with days 75% flowering, days to maturity, plant height, pods per plant, number of branches per plant, biological yield per plant and 100 seed weight.

Keywords: Coefficient of variation, genetic advance, genotypic correlation, heritability, phenotypic correlation, variability

Introduction
Mungbean (*Vigna radiata* L. Wilczek), which known as green gram is one of the most important pulse crops of Asia. In countries like India, food legumes, commonly known as pulses, are major source of dietary (24-27%) protein, which is 2 to 2.5 times higher than that of cereals. Its productivity is low which may be improved through employing the genetic variability appropriately. The estimates of heritable variances give a clue for possible improvement of the character under study. Association studies are fruitful while making selection in the field for augmenting the seed yield. The present investigation was, therefore, under taken to predict an appropriate plant type for selection as to improve the seed yield keeping in view the inter relation between traits and heritability.
Mungbean (*Vigna radiata* L. Wilczek), which belongs to the angiospermic dicot family: Papilionaceae is one of the most important pulse crops in many Asian countries including India, China and Pakistan as well as many tropical and sub-tropical parts of the world since it can be grown in a wide range of environment (Verdcourt, 1970) [16]. It occupies an important position due to its high seed protein content (about 24%) and the ability to restore soil fertility through symbiotic nitrogen fixation (Malik, 1994; Idress, Sadiq, Hanif, Abbas, & Haider, 2006) [7, 4]. Mungbean is rich in essential amino acids particularly lysine, which is deficient in most of the cereal grains (Suresh, Jebaraj, Juliet, & Theradimani, 2010) [15].

Material and Methods
During the present experiments forty genotypes including some exotic genotypes were utilized in order to gather information of genetic parameters and character associations the present experiment was conducted during the kharif season of 2010 along with their replications and a spacing of 10 x 30 cm was maintain as per plant to plant and row to row respectively. All the necessary agronomic practices were adopted to raise a healthy crop at the research farm of Kisan PG College, Simbhaoli, Hapur. Five plants were randomly selected to record observation, like days to 75% flowering, days to maturity, plant height, number of branches of per plant, number of pods per plant, number of seed per plant, seed yield per plant, biological yield per plant, 100 seed weight and harvest index. Genotypic and phenotypic coefficient of variation was also estimated as Burton (1952) [2]. Heritability and Genetic advance according to Hanson *et al.*, (1956) [3] and correlation coefficients were calculated as per formula suggested by Robinson *et al.*, (1951).

Results and Discussion

Significant differences were found among genotypes for all the traits except 100 seed weight in Table No. 1. Genetic parameters of variation, heritability and expected genetic advance as percentage over mean for seed yield and related traits are given in Table 1 and also illustrated in Figure 1. The genotypic and phenotypic coefficient of variation ranged from 3.10 to 16.24 and 3.23 to 18.31, respectively. The maximum phenotypic coefficient of variability were observed for (18.31) biological yield per plant followed by (16.94) number of branch per plant and (13.38) 100 seed weight gm. Similarly, maximum genotypic coefficient of variation were found (16.24) number of branch per plant followed by (15.79) biological yield per plant and (13.29) seed yield per plant. However, least genetic coefficient of variation and phenotypic coefficient of variation were observed for days to maturity to the tune of 3.10 and 3.23, respectively. Similar findings have also been reported by Rao (1994) [11]; Kumar *et al.*, (2010) [6]; Nand *et al.*, (2013) [8] and Prasanna *et al.*, (2013) [10].

High heritability estimates to the level of (>70%) were found for all the characters, except number of seeds per pod, seed yield per plant, 100 seed weight and harvest index. Where it was only 40% as depicted in Table 2 and illustrated in figure 1. The high heritability for economic traits including seed yield per plant gave pleasant indication for success in selection because of their heritable nature and can provide anticipated gain in selection. The genetic advance in percent of mean was the highest for number of branches per plant (32.06) followed by biological yield per plant (22.16%) whereas it was lowest for harvest index (5.09%). Similar findings were reported by Rao (1994) [11]; Singh (1999); Sirohi *et al.*, (2006) [13] in Pea, Sirohi *et al.*, (2007) [14] in Lentil, Kumar *et al.*, (2010) [6]; Nand *et al.*, (2013) [8] and Prasanna *et al.*, (2013) [10]. High heritability coupled with high expected genetic advance was observed for seed yield per plant, pods per plant and 100 seed weight indicated that these traits were least influenced by environmental interaction. Thus selection for these traits would be quite effective in enhancing seed yield per plant and its related attributes.

Correlation coefficients of seed yield per plant with other traits are presented in Table 3. Seed yield per plant exhibited significant and positive correlation with day to 75% flowering, days to maturity, plant height, number of branches per plant, number of pods per plant, biological yield per plant and 100 seed weight. Whereas days to 75% flowering with days to maturity, days to maturity with plant height with number of branches per plant with number of pods per plant and number of pods per plant with number of seeds per pod, seed yield per plant with biological yield per plant and biological yield per plant with 100 seed weight had positive and significance association. The studies revealed that seed yield per plant is the product of seeds per plant, biological yield per plant and 100 seed weight, whereas seeds per plant, depends on pods per plant, seeds per pod, plant height, branching and pod length. Therefore, due emphasis must be given on above mentioned traits for improving the productivity during selection.

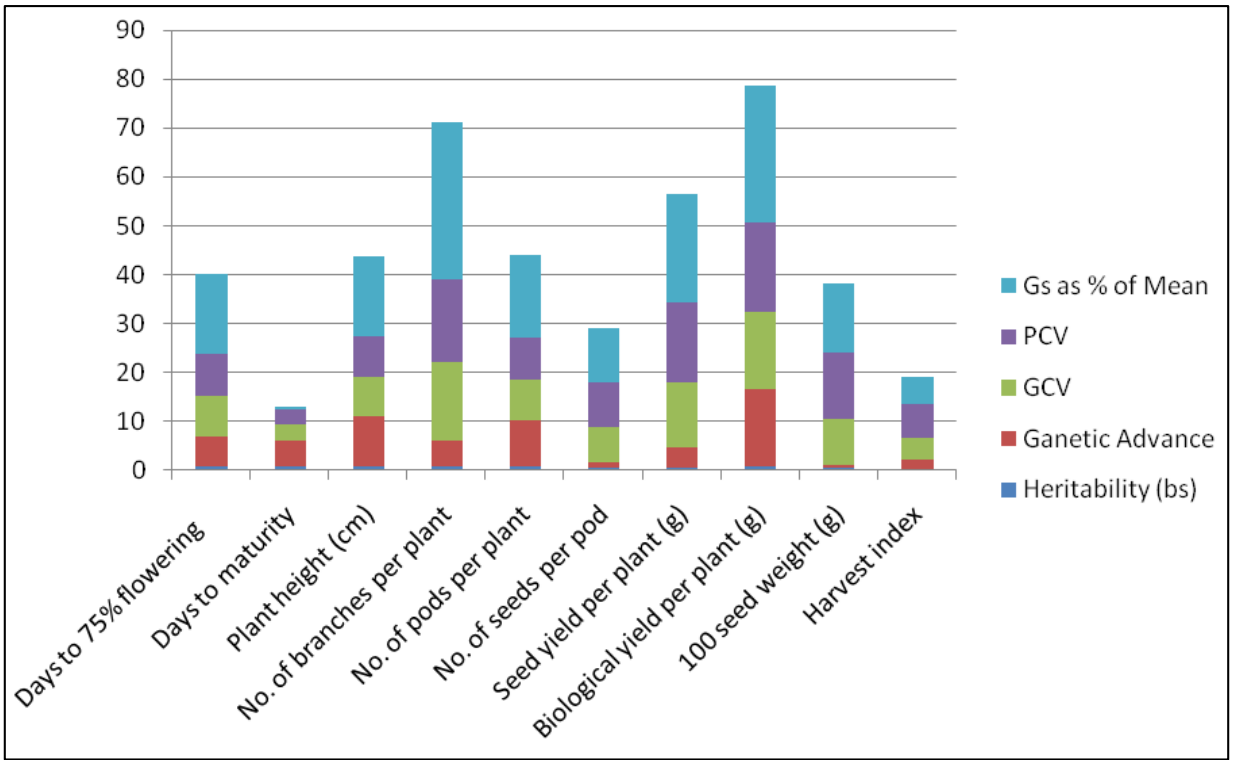

Fig 1: Showing different genetic parameters plotted against the characters

Table 1: Analysis of variance for 10 quantitative characters involving 40 genotypes over 4 environments in Mungbean

Source of variation	D.F	Days to 75% Maturity	Days to Maturity	Plant height (cm)	No. of branches per plant	No. of pods per plant	No. of seeds per plant	Seed yield per plant (g)	Biological yield per plant (g)	100 seed weight (g)	Harvest Index
Replication	2	2.625	0.375	2.015	0.450	0.543	0.055	0.779	31.015	0.273	1.371
Treatment	39	29.795**	21.925**	77.209**	20.15**	65.51**	1.821**	21.319**	268.255**	0.400	9.164**
Error	78	0.923	0.258	0.984	0.575	0.989	0.345	3.178	27.720	9.573	3.013

Table 2: Estimates of phenotypic and genotypic correlation coefficients among ten quantitative characters in 40 genotypes over four environments in Mungbean

Characters		Days to 75% flowering	Days to Maturity	Plant Height (cm)	No. of branches per plant	No. of pods per plant	No. of seeds per pod	Seed yield per plant (g)	Biologic-al yield per plant (g)	100 seed weight (g)	Harvest index
Days to 75% flowering	G		-0.285**	-0.163	0.098	-0.198	0.112	0.554**	0.689	0.169	-0.293**
Days to Maturity	G			0.809**	0.635**	0.840**	0.371**	0.277*	0.130	0.222*	0.171
Plant Height (cm)	G				0.449**	0.759**	0.187	0.217*	0.163	0.082	-0.035
No. of branches per plant	G					0.578**	0.522**	0.405**	0.367**	0.295**	-0.012
No. of pods per plant	G						0.353**	0.218*	0.114	0.232*	0.158
No. of seeds per pod	G							0.119	0.220*	0.229	-0.220*
Seed yield per plant (g)	G								0.932**	0.485**	0.208
Biological yield per plant (g)	G									0.393**	-0.162
100 seed weight (g)	G										0.005
Harvest index	G										

*, **, Significant at 5% and 1% level of significance, respectively.

Table 3: Estimates of heritability (broad sense), genetic advance, genetic advance as percent of mean, genotypic coefficient of variation (GCV) for 10 quantitative characters over 4 environments in Mungbean

Characters	Heritability(bs)	Genetic Advance	GCV	PCV	GS as % of Mean
Days to 75% flowering	0.912	6.10	8.26	8.64	16.23
Days to maturity	0.924	5.28	3.10	3.23	0.614
Plant height (cm)	0.963	10.19	8.04	8.19	16.24
No. of branches per plant	0.919	5.04	16.24	16.94	32.06
No. of pods per plant	0.956	9.34	8.33	8.52	16.77
No. of seeds per pod	0.588	1.11	7.05	9.20	11.16
Seed yield per plant(g)	0.655	4.10	13.29	16.41	22.16
Biological yield per plant (g)	0.743	15.90	15.79	18.31	28.03
100 seed weight (g)	0.515	0.47	9.60	13.38	14.15
Harvest index	0.405	1.88	4.34	6.82	5.69

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